

**WHAT IS CLAIMED IS:**

1. A method of processing an optical signal, comprising the steps of:

(a) inputting signal light into a first nonlinear optical medium to broaden the spectrum of the signal light through self phase modulation occurring in the first nonlinear optical medium, thereby obtaining first spectrally broadened light;

(b) compensating for chromatic dispersion effected on the first spectrally broadened light obtained in the step (a); and

(c) inputting the first spectrally broadened light processed by the step (b) into a second nonlinear optical medium to broaden the spectrum of the first spectrally broadened light through self phase modulation occurring in the second nonlinear optical medium, thereby obtaining second spectrally broadened light.

2. A method according to claim 1, wherein each of the first and second nonlinear optical media comprises an optical fiber.

3. A method according to claim 2, wherein the optical fiber provides normal dispersion.

4. A method according to claim 2, wherein the step (b) comprises the step of compensating for chromatic

dispersion occurring in the optical fiber.

5. A method according to claim 1, further comprising the step of providing an optical amplifier for amplifying the signal light to be input into the first nonlinear optical medium and/or the second nonlinear optical medium.

6. A method according to claim 5, wherein the step (b) comprises the step of compensating for chromatic dispersion occurring in the optical amplifier.

7. A method according to claim 1, further comprising the step of providing an optical bandpass filter for inputting the second spectrally broadened light obtained in the step (c).

8. A method according to claim 7, wherein the optical bandpass filter has a passband narrower than the spectral width of the second spectrally broadened light.

9. A method according to claim 8, wherein the center wavelength in the passband is different from the wavelength of the signal light, whereby the waveform of the signal light is improved.

10. A method according to claim 8, wherein the passband is narrow enough to extract an optical carrier from the second spectrally broadened light.

11. A method according to claim 8, wherein the

passband is wide enough to extract a pulse train synchronous with the pulse train of the signal light from the second spectrally broadened light.

12. A method according to claim 8, wherein the passband comprises a plurality of passbands.

13. A device for processing an optical signal, comprising:

a first nonlinear optical medium for inputting signal light to broaden the spectrum of the signal light through self phase modulation occurring in the first nonlinear optical medium, thereby obtaining first spectrally broadened light;

a dispersion compensator for compensating for chromatic dispersion effected on the first spectrally broadened light obtained by the first nonlinear optical medium; and

a second nonlinear optical medium for inputting the first spectrally broadened light processed by the dispersion compensator to broaden the spectrum of the first spectrally broadened light through self phase modulation occurring in the second nonlinear optical medium, thereby obtaining second spectrally broadened light.

14. A device according to claim 13, wherein each

of the first and second nonlinear optical media comprises an optical fiber.

15. A device according to claim 14, wherein the optical fiber provides normal dispersion.

16. A device according to claim 14, wherein the dispersion compensator comprises means for compensating for chromatic dispersion occurring in the optical fiber.

17. A device according to claim 13, further comprising an optical amplifier for amplifying the signal light to be input into the first nonlinear optical medium and/or the second nonlinear optical medium.

18. A device according to claim 17, wherein the dispersion compensator comprises means for compensating for chromatic dispersion occurring in the optical amplifier.

19. A device according to claim 13, further comprising an optical bandpass filter for inputting the second spectrally broadened light obtained by the second nonlinear optical medium.

20. A device according to claim 19, wherein the optical bandpass filter has a passband narrower than the spectral width of the second spectrally broadened light.

21. A device according to claim 20, wherein the center wavelength in the passband is different from the

wavelength of the signal light, whereby the waveform of the signal light is improved.

22. A device according to claim 20, wherein the passband is narrow enough to extract an optical carrier from the second spectrally broadened light.

23. A device according to claim 20, wherein the passband is wide enough to extract a pulse train synchronous with the pulse train of the signal light from the second spectrally broadened light.

24. A device according to claim 20, wherein the passband comprises a plurality of passbands.

25. A system comprising:

an optical coupler for splitting signal light into first and second signal lights;

an optical clock regenerator for generating clock pulses according to the first signal light;

an optical AND circuit for inputting the clock pulses and the second signal light to output converted signal light obtained by synchronization of the clock pulses and the second signal light; and

an optical signal processing device for inputting the converted signal light output from the optical AND circuit;

the optical signal processing device comprising:

a first nonlinear optical medium for inputting the converted signal light to broaden the spectrum of the converted signal light through self phase modulation occurring in the first nonlinear optical medium, thereby obtaining first spectrally broadened light;

a dispersion compensator for compensating for chromatic dispersion effected on the first spectrally broadened light obtained by the first nonlinear optical medium;

a second nonlinear optical medium for inputting the first spectrally broadened light processed by the dispersion compensator to broaden the spectrum of the first spectrally broadened light through self phase modulation occurring in the second nonlinear optical medium, thereby obtaining second spectrally broadened light; and

an optical bandpass filter for inputting the second spectrally broadened light, having a passband whose center wavelength is different from the center wavelength of the second spectrally broadened light, thereby obtaining a signal component of the inputted light.

26. A system according to claim 25, further comprising a waveform shaper for increasing the pulse width of the second signal light.

27. A system comprising:

- a first optical fiber transmission line for transmitting signal light;
- an optical signal processing device for inputting the signal light transmitted by the first optical fiber transmission line; and
- a second optical fiber transmission line for transmitting regenerated light output from the optical signal processing device;

the optical signal processing device comprising:

- a first nonlinear optical medium for inputting the signal light to broaden the spectrum of the signal light through self phase modulation occurring in the first nonlinear optical medium, thereby obtaining first spectrally broadened light;
- a dispersion compensator for compensating for chromatic dispersion effected on the first spectrally broadened light obtained by the first nonlinear optical medium;
- a second nonlinear optical medium for inputting the first spectrally broadened light processed by the dispersion compensator to broaden the spectrum of the first spectrally broadened light through self phase modulation occurring in the second nonlinear optical

medium, thereby obtaining second spectrally broadened light; and

an optical bandpass filter for inputting the second spectrally broadened light, having a passband whose center wavelength is different from the center wavelength of the second spectrally broadened light, thereby obtaining a signal component of the inputted light.